OCT 23 1941
Engng. Library

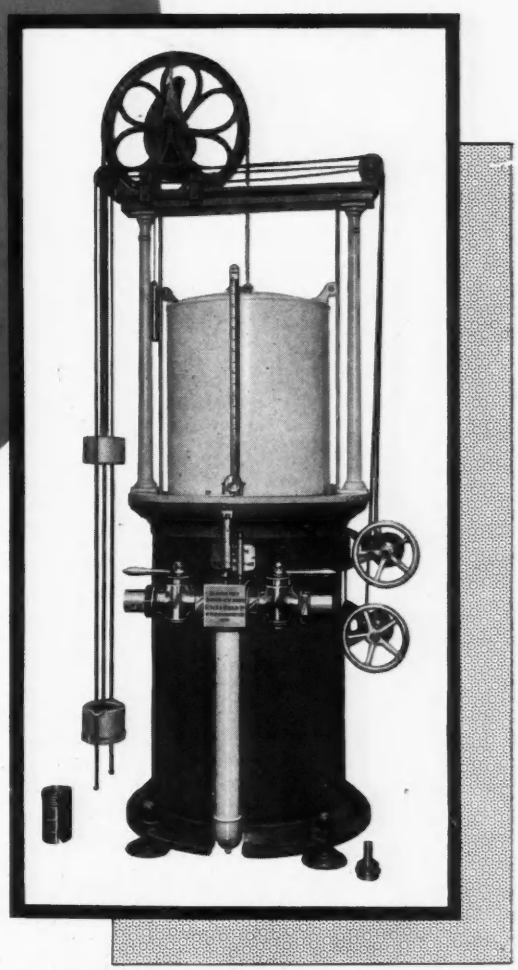
Gas Journal

LIGHT - HEAT - POWER - BY-PRODUCTS

Vol. 235. 93rd Year. LONDON, SEPTEMBER 17, 1941. Registered as a Newspaper No. 4087. Price 1/-

A STANDARD OF SUPREME CRAFTMANSHIP

A. & M. Standard Gas Test Holders



ALDER & MACKAY LTD
of Edinburgh

NEW GRANGE WORKS, STEWART TERRACE, EDINBURGH, 11
LONDON, BRADFORD AND BRANCHES

AUDCO VALVES

The Works Manager of one of the most important Gas Undertakings in Gt. Britain recently said :—

"I wouldn't risk using anything but Audco Valves for residuals under temperature, pressure or vacuum, for I have seen men killed by a burst vessel, due to a valve that had stuck at the crucial moment when *immediate* operation was required."

If Valve "life" is important—human life is infinitely more so.

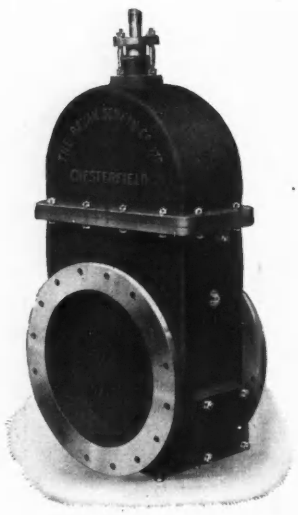
The "Audco" system of constant lubrication safeguards valve life by protecting metal surface from corrosion and human life from explosion.

ONE OPINION?, but not the only one—judging by the number of Gas Experts who insist, for safety's sake, upon AUDCO.

There is a specially designed AUDCO Valve for every Gas Works requirement. Write us for literature describing the unique advantages of AUDCO—the *only* Valve of its kind.

AUDLEY ENGINEERING COMPANY LIMITED
NEWPORT, SHROPSHIRE

GAS VALVES
Double Faced



"HICKS" TYPE.
For medium pressures up to about 5 lb. per square inch.

These valves have the following advantages :

Access to all working parts for cleaning while valve is under pressure.

Spindle and nut can be renewed while valve is in position.

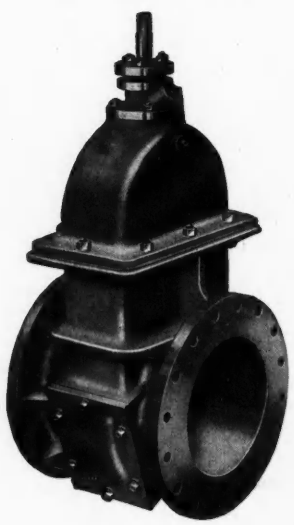
The valve is of the parallel slide type and cannot jam.

The two doors are separate and held against the faces by means of springs. The faces are, therefore, cleaned each time the valve is opened or closed.

The valves can be provided with plugs to enable the faces and spindles to be lubricated whilst in position.

Full clear bore.

"BAURER" TYPE.
For high pressures up to 100 lb. per square inch.



WE MAKE VALVES TO SUIT ALL CONDITIONS AND PRESSURES

THE BRYAN DONKIN CO., LTD.
CHESTERFIELD

Members of the Society of British Gas Industries

CONTENTS

EDITORIAL NOTES

William Young Memorial Lecture .. 431
The "Coke Incubus" 431

Personal 432
Obituary 432
Institution Committees of Enquiry .. 432
Industrial Fuel Consumption 432

National Gas Council 433
Gas Companies' Protection Association 433
Arkon Flow Indicator 433
North British Association of Gas Managers. 434
Benzole Recovery by Refrigeration .. 437
New Facts on Liquid Phase Gum .. 443

New Patents:
Mounting Heat Radiating Elements 446
Oven Heat Control 446

Gas Products Prices 445
Gas Stocks and Shares 445

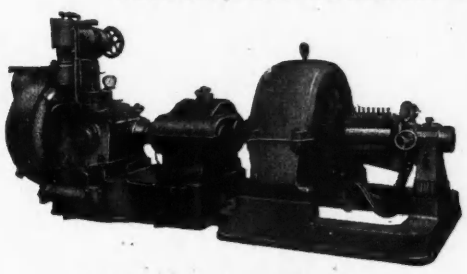
THIS WEEK'S ADVERTISERS

	PAGE
Alder & Mackay, Ltd. ...	Cover I
Ashmore, Benson, Pease & Co., Ltd.	420
Ashworth & Parker, Ltd. ...	422
Audley Engineering Co., Ltd.	Cover II
Bale & Church, Ltd.	449
Balfour, Henry, & Co., Ltd. ...	426
Blakeley, Firth, Sons & Co., Ltd.	449
Broom & Wade, Ltd. ...	Cover IV
Brotherhood, Peter, Ltd.	429
Cellactite & British Uralite, Ltd....	418
Clayton, Son & Co., Ltd. ...	452
Clough (Croydon), Ltd. ...	Cover IV
Cohen, George, Sons & Co., Ltd.	450
Cowan, W. & B.	Cover III
Crane, Ltd.	421
Dempster, R. & J., Ltd. ...	417
Dempster, Robert, & Sons, Ltd.	436, 449
Donkin Co., Ltd. (The Bryan)	Cover II
Drakes, Ltd.	423
Durasteel Roofs, Ltd.	450
Ellison Insulations, Ltd.	449
Ewart & Sons, Ltd.	449
Gas Meter Co., Ltd. ...	Cover IV
Gas Purification and Chemical Co., Ltd.	449
Glover, Thos., & Co., Ltd. ...	430
Grant & West, Ltd.	450
Harrisons (London), Ltd.... ...	449
Holden & Brooke, Ltd.	422
Holmes, W. C., & Co., Ltd. ...	451
Humphreys & Glasgow, Ltd. ...	428
Jeavons, E. E., & Co., Ltd. ...	448
Jenkins, W. J., & Co., Ltd. ...	427
Keith, Blackman, Ltd.	452
Lench, Thos. W., Ltd.	449
Main, R. & A., Ltd.	442
Mewburn, Ellis & Co.	449
Milnes Meters, Ltd.	426
Parkinson Stove Co., Ltd. ...	439
Parkinson, W., & Co.	430
Peebles & Co., Ltd.	447
Poles, Ltd.	426
Potterton, T. (Heating Engineers), Ltd.	447
Radiant Heating, Ltd.	425
Radiation, Ltd.	440, 441
Reavell & Co., Ltd.	425
Smith, Thos., & Sons (Rodley), Ltd.	422
South Hetton Coal Co., Ltd. ...	449
South Metropolitan Gas Company	445
Spencer-Bonecourt, Ltd.	424
Strachan & Henshaw, Ltd. ...	449
Trotter, Haines & Corbett, Ltd.	450
Underpressure Engineering Co., Ltd.	450
Walker, C. & W., Ltd.	424
Walker, James, & Co., Ltd. ...	420
Wellington Tube Works, Ltd.	Cover IV
West's Gas Improvement Co., Ltd.	444
Wheeler Foundry & Engineering Co., Ltd.	419
Withinshaw, A.	450
Woodall-Duckham Co., Ltd. ...	435
Appointments Vacant	450
Appointment Wanted	450
Contracts Open	450
Patents	450
Plant, &c.	449
Plant, &c., For Sale and Wanted	450

BROTHERHOOD
STEAM TURBINES FOR GASWORKS

Our Turbines, made for all powers up to 15,000 B.H.P. and for all conditions of service, are installed for driving Exhausters, Boosters, and Generators in many Gas Works, including:—

The Gas Light & Coke Co., South Suburban Gas Co., Wandsworth & District Gas Co., and in Works of Corporations and Companies at—Birmingham, Bristol, Coventry, Cardiff, Exeter, Liverpool, Manchester, Newcastle-on-Tyne, Preston, Portsmouth, Sheffield, Smethwick, Toronto, etc.



300 kW Back Pressure Geared Turbo-Generator.

Exhauster driven by 150 B.H.P. Steam Turbine at 13,000 r.p.m.

Brotherhood plant for Gas Works also includes Reciprocating Boosters, Water Cooling Towers, Air and Gas Compressors for all pressures and capacities.

PETER BROTHERHOOD LTD

PETERBOROUGH :: **Branch Offices in LONDON, LEEDS, MANCHESTER and GLASGOW**

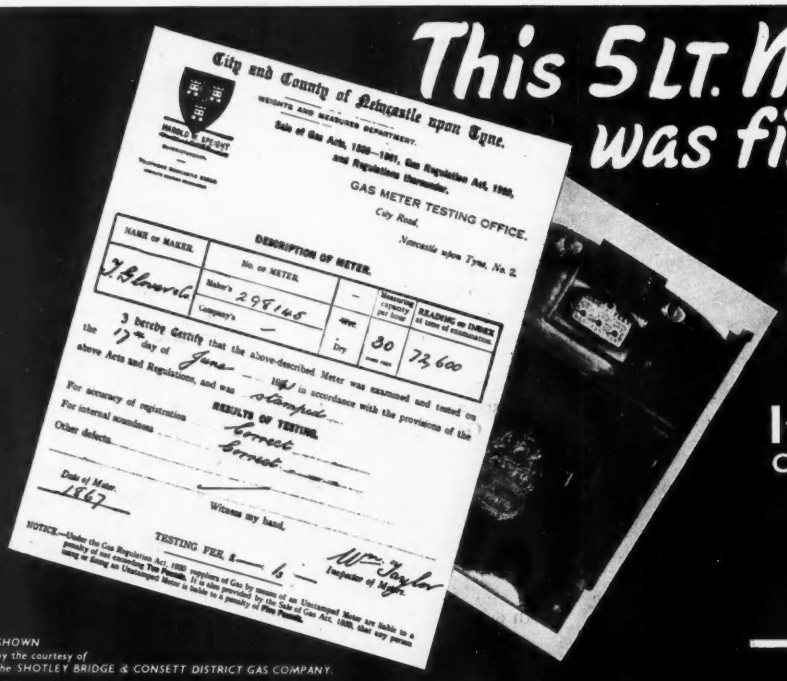
This 5 LT. Meter was fixed in....

1867

IT HAS NEVER BEEN REPAIRED

IT IS REGISTERING CORRECTLY IN....

1941


City and County of Newcastle upon Tyne.
WEIGHTS AND MEASURES DEPARTMENT.
Sale of Gas Acts, 1859—1861, Gas Regulation Act, 1920, and Regulations thereunder.
GAS METER TESTING OFFICE.
City Road, Newcastle upon Tyne, No. 2.
NAME OF MAKER. J. Glover & Co
DESCRIPTION OF METER. No. of METER. Maker's 298145 Company's —
Number of Lights per hour. — Wet 30 Dry
READING on INDEX at time of examination. 73,600
I hereby Certify that the above-described Meter was examined and tested on the 17th day of June 1867 in accordance with the provisions of the above Acts and Regulations, and was stamped
For accuracy of registration RESULTS OF TESTING. Correct
For internal soundness Correct
Other defects
Date of Meter 1867
Witness my hand.
TESTING FEE, 1s. 6d. Wm. Taylor Inspector of Meters.
NOTICE—Under the Gas Regulation Act, 1920, regulators of Gas by means of an Unstamped Meter are liable to a penalty of not exceeding Ten Pounds. It is also provided by the Sale of Gas Act, 1859, that any person using or having an Unstamped Meter is liable to a penalty of Five Pounds.

SHOWN by the courtesy of the SHOTLEY BRIDGE & CONSETT DISTRICT GAS COMPANY.

THOMAS GLOVER & Co. LTD.

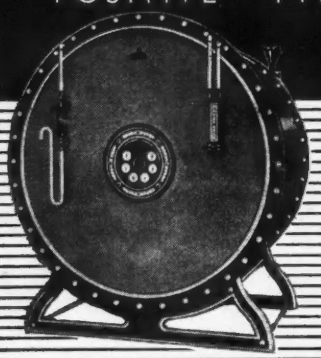
EDMONTON LONDON N. 18 AND BRANCHES

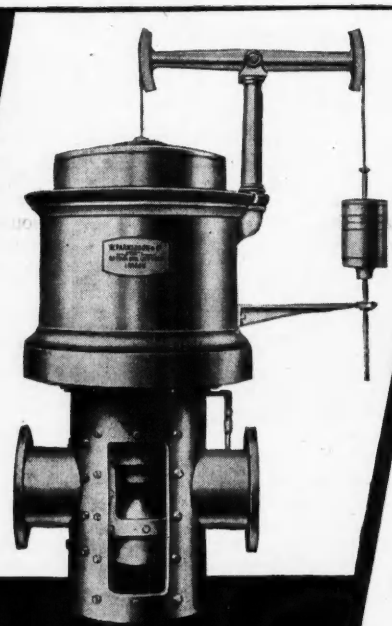
PARKINSON

STATION GOVERNORS

STATION METERS

"POSITIVE" TYPE





THE SOCIETY OF BRITISH GAS INDUSTRIES 1905

W. PARKINSON & CO.

(Incorporated in Parkinson & Cowan (Gas Meters) Ltd.)

COTTAGE LANE WORKS, CITY ROAD, LONDON, E.C.1

Also at

BIRMINGHAM AND BELFAST

P.6

GAS JOURNAL, SEPT. 17, 1941

VOL. 235 93rd YEAR No. 4087

EDITORIAL NOTES

WILLIAM YOUNG MEMORIAL LECTURE

IN our issue last week we published in full the William Young Memorial Lecture delivered by Mr. Dean Chandler to the North British Association of Gas Managers, and in the same issue we gave our general impression of what was a virile gathering of young and not so young members of the Scottish Gas Industry in Edinburgh. It is no easy task in these days to give an Address or a Paper concerning the internal affairs of any industry. Not that material is lacking; quite the reverse. In common with other industries the Gas Industry is exceedingly active and is playing its part in the war effort. The point is, of course, that most of what could be told must be withheld from publication, for obvious reasons. Bearing in mind this handicap, we think that Mr. Chandler's choice of subject—or, rather, range of subjects—was a happy one, particularly in view of the attention which is rightly being centred on the future welfare of the Industry.

Early in his Lecture the Author suggested that we might, inspired with the spirit of self-sacrifice and co-operation which war has evoked, give thought to the pre-war overlapping of gas and electricity services. There is a great field for the expansion of both these services; the aim, however, should be to ensure that in this expansion the public interest do not suffer. For the period of the war we have an official "understanding" between the gas and electricity industries. How are we going to make use of the opportunity it presents? Mr. Chandler contended that we must come together and plan a joint programme for the advancement of our interests, but always with the "public interests" as the criterion. "We have," he said, "to achieve a new outlook so that if it is of no economic advantage to consumers to change from gas to electricity, or electricity to gas, the imagined advantage of one industry shall no longer require its representatives to damn its competitor by exaggerations and ill-founded statements as reasons for a change. By continually exchanging the apparatus of the unstable minded we merely pile up costs and the public interest suffers." Obviously the various fields of activity for gas and electricity will be the basis for exhaustive argument, but with the public good always in mind it ought to be possible to arrive at a working agreement which, while benefiting the consumer, does not stultify progress and development in either industry. As an ultimate aim the Author envisaged a national body embracing the coal, carbonizing, electricity, chemical, and, to a large extent, domestic oil industries.

Comparison between the vigorous central control of the electricity industry and the "diffuse corporate structure" of the Gas Industry is to the disadvantage of the latter when co-operation is in question ; hence Mr. Chandler's plea for the establishment of an authoritative as distinct from a merely advisory organization in the Industry. This matter must by now be in the forefront of the minds of all thinking men in the Industry; it is the first step towards any form of effective co-operative planning. The Industry, after the war, must be in a position to state its case clearly and with one voice, and the time to begin preparing this case is now. Under unified control each industry would deal with its own internal economy. The public interest will demand the elimination of wasteful competition. It will demand, also, legitimate competition between the individual fuels, acting as a spur to technical improvements in all branches. It is not difficult to imagine a technical advance in a particular form of energy lowering its cost and making its use economic for hitherto unattainable purposes. But, we would emphasize again, the field for future extension and development is immense, for all the fuels and forms of energy. What we have to strive for is the best and most economical service to the consumer. The incidence of the cost of wasteful competition on the price of gas is, we think, insufficiently realized. The Industry and the public have been the losers.

An item of strictly technical interest in the Lecture was the development of the "luminous" burner. In its application to both specially designed cookers and fires the South Metropolitan Gas Company has undertaken a great deal of investigational work in recent years, the results of which have from time to time been published in the "JOURNAL." At the meeting in Edinburgh Mr. Chandler demonstrated two new types of cooker—one with solid hotplate—designed by the Company and employing luminous flames throughout, and also an example of a new fire also employing luminous flames. We feel sure that the future will see far greater use of this form of burner in both domestic and industrial gas appliances.

THE "COKE INCUBUS"

WE must, however, confess that we were puzzled, and remain puzzled, with that part of Mr. Chandler's Lecture in which he spoke of a "coke incubus." Although, he remarked, the sale of coke at a presumed remunerative price was increasing in pre-war days, gas still had to carry the costs of production which coke was unable to bear if it was to remain saleable. And, he added—we quote this paragraph in full: "The alternative method of obtaining cheap gas seemed to lie in the elimination, as far as possible, of the coke incubus, so that gas could be freed from the losses on coke. This indicated the evolution of complete gasification processes and their development to commercial propositions. To be an economic success the gasification of coke, by methods suitable for the production of a gas of calorific value and combustion characteristics similar to those of the coal gas, which it will accompany or replace, need not produce this gas at a lower price than the straight coal gas. If the complete gasification product works out at the same figure as the original coal gas only, the latter is freed from the penny a therm or so loss on coke and the combined process shows a saving. The complete gasification schemes ready for the commercial-scale trial stage, however, show promise of better results than this."

As we said last week, we cannot subscribe to the opinion that coke should be regarded as a charge on gas manufacture; and this, we added, does not cloud our hope that complete gasification effected by new methods under investigation will eventually reduce the cost of the effective gaseous therm to that of the effective thermal output in use of solid smokeless fuel (labour considerations, and so on, taken into account). Looking to the present and the immediate future, however, we simply cannot understand the significance of the "coke incubus" to which Mr. Chandler referred. We like to think that our mind retains elasticity, but we maintain that revenue from coke makes possible the sale of gas at a competitive price, and we believe that the Gas Industry would be in a sorry state without the coke market. If coke is an "incubus," why does the Industry manufacture it ?

We have not heard a great deal lately about what we may call the Leeds researches into the gasification of coal by hydrogen under pressure. We know, of course, that the work is being continued, but that it is not considered to be in the public interest to disclose the results at the present time. We have the Joint Committee on Complete Gasification which works under the authority of the Gas Research Board, and in the Board's

first report ("JOURNAL" of Dec. 4, 1940) it was stated that "the production of methane by the gasification of coal in hydrogen under pressure has not lost its interest, but circumstances arising from the war have made it impossible so far to proceed with the large-scale experiments that had been planned in co-operation with the Fuel Research Board. There is some possibility that other arrangements for the continuance of this work may be available and the Joint Research Committee will take advantage of any and every opportunity that offers itself." It was common knowledge that at that time the laboratory results had not been translated to anything like large-scale practice.

Mr. Chandler spoke of the complete gasification of coke and of schemes "ready for the commercial-scale trial stage," which schemes show, it would appear, great promise. Naturally we follow the Gas Industry's work with keenest attention, and it is for this reason that we feel at the moment rather in the dark concerning this "commercial-scale trial stage" of new complete gasification processes. We suggest that the matter is of such importance to the Industry that Mr. Chandler's statement might receive further elucidation and amplification from the Gas Research Board. Has the work at Leeds—truly excellent work—already led to a stage at which we can consider commercial plants? Or is it that very much more investigation on a scale larger than the laboratory is required before any pronouncement of a definite nature can rightly be made? So much depends on the answers to these questions, now that we are planning vigorously for the post-war era.

Personal

Mr. F. T. HATSWELL, who took temporary control of the Wombwell U.D.C. Gas Undertaking following the death of Mr. E. J. WELLENS, has now been appointed Engineer and Manager. Mr. Hatswell began his technical career at the Mitchell Main Colliery where he was Chemist and afterwards Manager, and in 1935 he went to India as Assistant Coke-Oven Manager for the Indian Iron and Steel Company.

Obituary

Henry Dacre Madden

The death has taken place of Mr. H. D. MADDEN, whose retirement from the position of Engineer and Manager to the Cardiff Gas Light & Coke Company, after 35 years' service, we announced in April last.

He joined the Company in 1906 as Station Manager of the Grangetown Works, becoming Chief Engineer in 1909. On the retirement of Mr. George Clarry, the General Manager and Secretary, in 1923, Mr. Madden was appointed to the position of Engineer and Manager.

Mr. Madden was a Member of the Institution of Civil Engineers, and also of the Institution of Mechanical Engineers.

During his long connexion with the Gas Industry, Mr. Madden held from time to time very important positions in different organizations of the Industry He was President of The Institution of Gas Engineers for the year 1927–28 (the first President to come from a Welsh undertaking), Chairman of the Executive Committee of the British Commercial Gas Association in 1939, and was on three occasions elected to the Presidency of the Wales and Monmouthshire Association of Gas Engineers and Managers. He was a member of the Executive Committee of the National Gas Council for many years, and Chairman of the South Wales District Board of that body. He served for several periods as a member of the Council of the Institution and since 1932 acted in the capacity of Hon. Auditor. He was continuously on many of the technical committees of the Institution.

From 1929–33 Mr. Madden was a member of H.M. Fuel Research Board, and was appointed Honorary Gas Engineering Adviser to the Regional Commissioner for Wales in November last.

* * *

Sergeant-Observer JOHN COLLARD WIMHURST, R.A.F., of Newcastle-under-Lyme, previously posted as missing in July, is reported killed. Before joining the Royal Air Force he was technical assistant at the Newcastle-under-Lyme Gas-Works, where his father, Mr. F. M. Wimhurst, is Manager. Joining the R.A.F. Volunteer Reserve in 1939, Sergeant Wimhurst was called up for service at the outbreak of war. Attached to Bomber Command, he was an experienced Observer and made numerous flights over occupied territory before being drafted to the Middle East as an instructor in June last.

Institution Committees of Enquiry

In the "JOURNAL" of Aug. 27 we were able to give preliminary intimation of the formation by the Council of The Institution of Gas Engineers of four small Committees of Enquiry to investigate some of the problems discussed at the Institution meeting last June. Their appointment was the subject of Editorial comment in that issue (p. 319).

We now give the membership of these committees and their terms of reference:

(1) To enquire into and make recommendations on the most suitable quality of gas, from all aspects, for supply to consumers in Great Britain (including the possible desirability of more than one standard quality of gas):

George Dixon, B.Eng. (Chairman) (Nottingham).
E. Crowther, M.Eng. (Newcastle-upon-Tyne).
T. Campbell Finlayson, M.Sc. (Guildford).

(2) To enquire into and make recommendations on the removal of sulphur from town gas:

H. Hollings, D.Sc. (Chairman) (London).
G. E. Currier (Bradford).
H. Hartley, D.Sc. (Birmingham).

(3) To enquire into and make recommendations on the standardization of domestic consumers' appliances:

F. B. Richards, M.B.E. (Chairman) (Guildford).
Dean Chandler (London).
R. J. Rogers (Birmingham).

(4) To enquire into and make recommendations on coke grading and on the properties of coke in relation to its domestic and industrial utilization:

Colonel H. C. Smith, J.P. (Chairman) (London).
W. L. Boon (London).
T. F. E. Rhead, M.Sc. (Birmingham).
Samuel Tagg, J.P. (Preston).

The Committees will consider not only the material contained in the several Papers and the discussions thereon at the Annual General Meeting, but also further evidence and expressions of opinion from all interested parties. The Chairmen of the several Committees invite all those who may wish to submit their views on these subjects to send, as soon as possible, four copies of a *précis* of their evidence to the Secretary of The Institution of Gas Engineers, 1, Grosvenor Place, London, S.W. 1.

Industrial Fuel Consumption

Committee to Advise the Mines Secretary

The Secretary for Mines announces that he has set up a Committee to advise on the many technical aspects of efficiency and economy in industrial fuel consumption. The Committee is constituted as follows: Mr. E. S. Grumell, D.Sc. (Chairman), Head of Fuel Economy Department of Imperial Chemical Industries; Mr. J. G. Bennett, Director of British Coal Utilization Research Association; Mr. W. L. Boon, General Manager of London and Counties Coke Association; Mr. W. J. Drummond, Member of the Central Committee of the Mining Association and Managing Director of Ashington Coal Company, Ltd.; Mr. E. V. Evans, General Manager of South Metropolitan Gas Company and Chairman of the Gas Research Board; Sir Clement Hindley, Past-President, Inst.C.E.; Mr. R. J. Sarjant, D.Sc., technologist of the iron and steel industry (with Hadfields Ltd.); Mr. F. S. Sinnatt, D.Sc., Director of Fuel Research of Department of Scientific and Industrial Research; Mr. Johnstone Wright, Chief Engineer of the Central Electricity Board.

The Committee will work in conjunction with a staff of combustion engineers who have been placed at the disposal of the Mines Department by the Coal Utilization Joint Council. In addition, the advice of the coal survey officers of the Department of Scientific and Industrial Research is being made available.

The Following Meetings of the Institution of Gas Engineers have been provisionally arranged to take place in September and October:

Friday, Sept. 19, 12.15 p.m. Liquor Effluents and Ammonia Committee.

Tuesday, Sept. 30, 2 p.m. Chairmen's Technical Committee.

Monday, Oct. 13, 1.45 p.m. Finance Committee; 2.15 p.m. Membership Committee; 3 p.m. General Purposes Committee; 4.30 p.m. Benevolent Fund Committee of Management.

Tuesday, Oct. 14, 10 a.m. Council; 2 p.m., Gas Education Executive Committee.

Miss Florence Garrett, who has been appointed canteen adviser of the Industrial Welfare Society, was on the staff of the Gas Light & Coke Company before the war. In her new job Miss Garrett advises and assists factories in the provision of works canteens and answers problems that arise out of their administration. She has helped with the preparation of a standard text-book on canteen management issued by the Industrial Welfare Society.

The Next Meeting of the Refractory Materials Joint Committee of The Institution of Gas Engineers will be held at Gas Industry House on Thursday, Oct. 2, at 2 p.m.

NATIONAL GAS COUNCIL

Meeting of Central Executive Board

A meeting of the Central Executive Board of the National Gas Council was held at Gas Industry House, London, S.W. 1, on Tuesday, Sept. 9; Sir David Milne-Watson, Bart., LL.D., D.L., presided.

The late Mr. H. D. Madden.—Before proceeding to the business of the meeting, the Chairman reported with deepest regret the death of Mr. H. D. Madden, formerly Engineer and Manager of the Cardiff Gas Light and Coke Company, and said that his loss would be felt very keenly by his many friends throughout the Industry, who held him in great esteem. The members of the Board stood in silence for some minutes, in respect to his memory.

Rating and Valuation.—(*a*) *Position of Rating Assessments of Gas Undertakings.*—The Board agreed as to what might be considered a reasonable basis of assessment where the profits basis failed. (*b*) *Retaining fee of Messrs. Ryde, Sons & Browne.*—The Board agreed to renew their retainer to this firm for their services to the Industry as consultants in matters of rating, having regard to the many rating and valuation problems likely to arise in the near future.

Gas Charges.—*General Licence dated Aug.* 15, 1941, *made by the Board of Trade, authorizing undertakers to increase the price charged in respect of the supply of gas at any factory.* It was reported that a number of undertakings had made enquiries as to the interpretation of the term "factory" under this order. Discussion also took place with regard to the interpretation of the General Licence dated June, 1941. It was agreed that the officers should seek a ruling on these points from the Board of Trade.

Post-War Planning.—The Board appointed a committee, consisting of three representatives each from the National Gas Council, The Institution of Gas Engineers, the British Commercial Gas Association, and the Society of British Gas Industries, with power to co-opt, to act as a liaison committee to collate information and to formulate suggestions for post-war planning so far as concerns the Gas Industry.

Benzole.—A Memorandum dealing with the extraction of benzole was considered by the Board and referred to the Benzole Committee of the Council for consideration and report.

Coal.—It was reported that deliveries to gas undertakings were substantially larger, and it was hoped that these would be improved yet further in the next few weeks.

GAS COMPANIES' PROTECTION ASSOCIATION

Report of the Committee for Oct. 1, 1939, to Mar. 31, 1941

The following are extracts from the Report, signed by the Chairman, Mr. F. G. Brewer:

As in the case of other similar bodies, it has been thought better not to hold an annual general meeting. From time to time during the period under review further war legislation, directly or indirectly affecting the Gas Industry, has been passed, and on much of this circulars have been issued to members. In addition advice has been given to many companies on various subjects arising from such legislation. Among these subjects may be mentioned particularly the Defence (Gas Charges) Orders, 1939 and 1940.

The Gas Industry is now awaiting the introduction of the separate legislation which, it has been indicated, will deal with compensation for public utility undertakings for war damage to their property and equipment. In the meantime the War Damage Act, 1941, has limited application to them. Statutory undertakings and all concerns whose rating assessments are made by reference to their accounts, profits or output, are exempt from contribution under Part I of that Act in respect of their lands, buildings, and other immovable property, as the rate and method of their contribution will be dealt with in the promised legislation; but Section 40 of the War Damage Act provides that the War Damage Commission may make advances to such undertakings towards the cost of repairs necessitated by war damage and urgently required for the carrying on of their services. By virtue of the relief provided under Section 6 (2) (*h*) of the War Damage (Business Scheme) Order, 1941, statutory undertakings are also exempt from compulsory insurance of their business equipment under Part II of the Act; but this exemption does not extend to non-statutory concerns.

Reference should also be made to the Essential Buildings and Plant (Repair of War Damage) Act, 1939, under which company-owned gas undertakings may apply to the Board of Trade or to the Housing Authority for a loan of the amount necessary for carrying out repairs to buildings. For repair or reinstatement of plant, application for such a loan has to be made to the Board of Trade.

During the period under review the Committee acting jointly or the National Gas Council and the Association completed negotiations with the Board of Inland Revenue with reference to the Mills and Factories Allowance under Section 15 of the Finance Act, 1937. The same Committee also completed negotiations with the Board in regard to the rates of depreciation allowances.

The Conjoint Conference of Public Utility Associations (on the Council of which the Association is represented by the Chairman, the Vice-Chairman and Messrs. J. B. Brown, E. J. K. Fussell, D. H. Helps, and W. Phillips) has dealt with a variety of subjects during the period covered by this report; and among those with which the Association has been more directly concerned may be mentioned compensation for war damage; repairs to highways and services damaged by enemy action; Railway (Demurrage Charges) Order, 1939; and standard conditions of coal contracts.

On the matter of rating, which has continued to engage the attention of the Conjoint Conference, the Committee regrets to have to record that, in cases where the hereditaments of undertakings are contained within more than one rating area or more than one county, instances still occur of the rating authorities of the several areas refusing to agree to the valuation of the undertaking as a whole by one valuer. The consequent multiplicity of valuations of a single undertaking is, in the opinion of the Committee, most undesirable, and a waste of public money, and, in view of the Central Valuation Committee's recommendation, it is urged that undertakings should not be called upon to deal with more than one valuer.

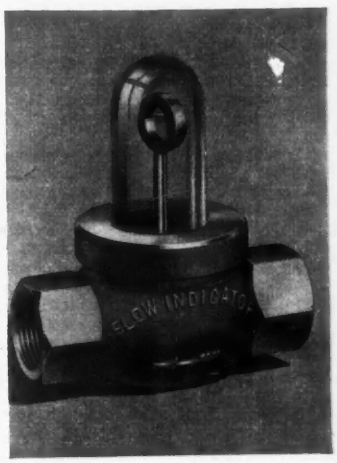
The revised draft British Standard specification for steel spigot and socket pipes and specials for water, gas and sewage was considered and approved by the Committee. Another matter on which the British Standards Institution asked for the Association's co-operation was that of war emergency standards.

The Association has, as in former years, advised members on many subjects, among which the following may be mentioned. Defence (Finance) Regulations, 1939; Capital Issues (Exemption) Order, 1939; charges for public lighting suspended during the war; transmission of stock; premiums on debenture stock; price increases; excess profits tax; consumer's liability for money in slot meter; closing down of works; Defence (Gas Charges) Orders; payment of wages during illness; preservation of old stock certificates and transfer deeds; conversion of debenture bonds to bearer; amendment of rating valuation; compensation for war damage to works and plant; stamp duty on co-partnership stock transfers; wages of trade union gas workers; gasholder inspection; form of accounts; revision of simple hire charges; income tax on contributions to gas exhibit; rates of deduction from interest and dividends; mills and factories allowance; in respect of disused works; rates of depreciation allowances.

Mr. C. C. Walmsley, General Manager and Secretary of the Sunderland Gas Company, has been elected a member of the Committee in place of Mr. W. H. Johns, who did not seek re-election at the last annual general meeting.

Arkon Flow Indicator

An improved type of visible flow indicator known as the "Arkon" is announced by the makers, Messrs. Walker, Crosweller & Co., Ltd., Cheltenham, Glos. The flow indicator is primarily intended for use on pressure lubricating lines, water-cooling lines, cooling coils, &c., on turbines, compressors, gear trains, and internal-combustion engines, but its application is of value wherever a flow of oil or water is to be maintained, particularly in closed circuits or as a "tell-tale" indication on overflows from tanks, &c.



The Arkon flow indicator is simple in construction and operation and there is only one moving part, the steel spindle. A heavy bronze body contains a cast propeller on a stainless steel spindle; on the other end of the spindle is mounted the flag—a chequered disc. The flag is enclosed in a dome of specially toughened glass (tested hydraulically to over 500 lb.). Oil or water, as it passes, spins the disc and so gives a visible indication that the flow is not interrupted, as would be the case if the disc became stationary. It is made in standard sizes of ½ in., ¾ in., 1 in., 1¼ in., and 2 in. Larger sizes, however, can be made to order or alternatively a by-pass can be used. The indicator is suitable for operating at pressures up to 50 lb. per sq. in.

The whole arrangement is neat and reliable and is a simple method of seeing at a glance whether liquids are flowing in pipe lines.

Since the Announcement in our issue of Aug. 27 of new officers for the Scottish Juniors (Eastern District), Mr. J. F. Wilson (late of Perth) has been appointed Technical Assistant at Leicester. Mr. T. B. Livingstone (now Vice-President) has agreed to continue to act as Hon. Sec. and Treasurer of the Association pending other arrangements.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS

THE Annual Meeting of the North British Association of Gas Managers was held on September 5, in the North British Station Hotel, Edinburgh, the President, Mr. R. D. KEILLOR, Greenock, extending a welcome to a large gathering.

The SECRETARY, Mr. Robert Sturrock, Ardrossan, read the minutes of the Annual Meeting last year, and of the Spring Meeting, 1941, and these were approved.

The PRESIDENT referred to the loss sustained by the Association by the death of Mr. Robert G. Shadbolt, Birmingham, who was elected an Honorary Member in 1912, and of Mr. James Taylor, Glasgow, elected an Extraordinary Member in 1936. Members were upstanding as a mark of respect.

Sir FREDERICK J. WEST, President of The Institution of Gas Engineers, reminded his hearers that he had addressed them at their Spring Meeting, when he deputized for Mr. George Dixon. Now, as President of the Institution, he conveyed to them the greetings of the parent body. The Annual Meeting of the Institution held in June had been most successful, and, despite the difficulties of transport, had been well attended. It had been a happy idea on the part of Mr. Dixon to arrange for a number of Papers dealing with different problems that faced their Industry. There had been a good discussion, and four committees had been set up to consider certain matters and make recommendations. These committees would deal with questions like the quality of gas; the removal of sulphur; the standardization of consumers' appliances; the grading of coke to suit domestic and industrial users. These committees would ask for evidence, written and oral, on these subjects, and members of the Gas Industry would be asked to give what help they could. They desired the co-operation of the North British Association in dealing with the problems that would face them in the days to come.

The PRESIDENT expressed the appreciation of the members at having Sir Frederick West with them.

The Annual Report and Financial Statement, being in the hands of the members, was taken as read and was approved.

Further to the names appearing in the Annual Report, the Secretary announced that the following had been admitted to membership: Messrs. E. G. Smith, Dumbarton; D. M. Kerr, Kingskettle; L. Friedman (Ascot Gas Water Heaters, Ltd.); and R. Lindsay, of A. G. Brown and Co., Ltd., Glasgow.

Certificates.—Higher Grade Certificates in Gas Engineering (Manufacture) presented by the Institution as a result of the 1941 examinations were handed over by the President as follows:

External—Second class: T. G. Pringle, Edinburgh.

Internal—1st class: D. Beavis, Helensburgh.

2nd class: C. A. Campbell, Glasgow; D. C. Dow, Kirkintilloch; A. McFadyen, Dumbarton; J. C. Marshall, Glasgow.

Mr. DEAN CHANDLER thereafter read his William Young Memorial Lecture. This was published in the "JOURNAL" of Sept. 10.

The PRESIDENT said the lecture was one of the most original and statesmanlike of the series. They were indebted to Mr. Chandler and to his Board for the apparatus which was being demonstrated that day in conjunction with the lecture.

Mr. DAVID FULTON, Helensburgh, proposing a vote of thanks, said it was interesting to find a personal link between Mr. Chandler and William Young. He had paid a tribute to the latter as an experimenter and a man of ideas. They owed him a great deal. The lecturer had also expressed the view that gas, electricity, coal, and oil should get together to serve the nation economically. They all agreed that wasteful competition should not be permitted, but the entire elimination of competition might discourage enterprise and initiative. Reference has been made to the loose way in which gas undertakings and Associations were linked together, and the lecturer wisely saw a day coming when they would have greater unification. With regard to the coke question there were two schools of thought, but opinion was growing that the Gas Industry should not be dependent on the sale of residuals. Mr. Chandler was an apostle of the all-gas production idea. The sulphur question loomed largely in their minds. Sulphur-free gas was necessary to their future existence.

Seconding the vote of thanks, Mr. ROBERT COWIE, jun., Hawick, said his appearance there was a compliment to the Waverley Association, of which he was President. They had listened to a novel Address. It was perhaps a prophetic one. They had their problems at present, but it might well be that their post-war difficulties would be even greater. It was to be hoped that they would be tackled with courage, breadth of outlook, and public spirit. Mr. Chandler had given them a lead. He was continuing the process of fertilizing the Gas Industry with ideas, as William Young himself had done.

Luncheon Speeches

At a luncheon held subsequently in the North British Hotel, Mr. R. D. Keillor in the chair, the toast of "The Gas Industry" was proposed by the Right Hon. The Earl of Rosebery, D.S.O., M.C., Regional Commissioner for Scotland.

"I am very glad," said His Lordship, "to have this opportunity of meeting so representative a gathering of gas engineers and of making the acquaintance of the men upon whom the duty of maintaining our gas supplies in good times and bad so largely depends. As Regional Commissioner I have to apply my mind to many different subjects, for the field of Civil Defence is a wide one. It covers everything, indeed, connected with the maintenance of the life of the community. From that point of view not the least important task is the maintenance of gas supplies.

"I am afraid that before the heavy bombing of our cities began many of us took the supply of gas for granted. We were only vaguely aware of the organization and careful planning that lie behind it. Certainly few of us realized how important a place the service occupied in our daily lives. We had to be temporarily deprived of it to realize that. An experience such as that of Coventry gave a sharp jolt to the Government, and those responsible for the Civil Defence Services. To lose gas is commonly to lose vital production in the factories, and cooking and heating facilities in the homes. If the service were not restored quickly the war effort would be seriously weakened alike from the point of view of loss of production and, what is perhaps more important, loss of morale. The Government did well, therefore, through the Board of Trade, to take steps to ensure that every possible help would be given to a stricken area in this as in other respects.

"I have no doubt that you are all aware of the mutual aid schemes which have been devised in the various Regions for the repair of war damage to gas undertakings. In Scotland the mutual aid scheme has been interlocked with the Civil Defence organization which, as you know, consists of five Civil Defence Districts within the Region. An undertaking which suffers damage first relies upon its own resources. but, if necessary, it can call in the help of other undertakings in the immediate neighbourhood through a group leader or through the District Gas Engineering Adviser. In the last resort help can be thrown in from other districts and, if need be, from other Regions. I have no need, however, to describe the scheme in detail to a gathering like this. What I do want to say is that the scheme is not merely one on paper. It has been tested both on a large scale on the Clyde and on a smaller scale elsewhere, and in every respect it has 'delivered the goods.'

"It is only fitting that I should take this opportunity of publicly thanking all of you for the co-operation which has made this success possible. In particular I should like to pay a tribute to Mr. Jamieson, the Regional Gas Engineering Adviser, who framed the mutual aid scheme and brought it into operation. Mr. Jamieson's undoubted ability, energy, and enthusiasm, which he has freely placed at my disposal, have been a great asset to my organization and through it to the country. I feel confident that so far as gas is concerned we are ready in Scotland to deal with the worst that Hitler can send us through the coming winter."

Replying, Sir FREDERICK J. WEST, C.B.E., said that when in Glasgow at their Spring Meeting he had referred to problems past and present in gas engineering. To-day he would refer to future problems. The word "reconstruction" was often used, but it was not a word that was applicable to such an old-established Industry as theirs. He preferred to think of "post-war planning" for the problems which were bound to arise. There was tremendous scope for careful thinking and planning. The spending power of the country would be differently distributed after the war. There would be a considerable increase in moderate incomes and a substantial decrease in high incomes. A higher standard of comfort at a lower cost would be demanded. The public would demand amenities which could best be provided by the Gas Industry. There would be a demand for continuous hot water, for refrigeration, for ventilation, for heating that would be noiseless, clean, and thermostatically controlled. The fuel problems would have to be considered as a whole. When it was a question of heat gas was cleanest and, in the long run, most economical. The restoration of houses damaged by enemy action would be a chance for the Gas Industry to see that full advantage was taken of the labour-saving and space-saving possibilities of gas equipment. They had to consider whether houses should be built with the minimum of gas appliances or whether the landlord should put these in with the building and charge accordingly.

Mr. HECTOR MCNEILL, M.P., Greenock, proposing the toast of "The City and Royal Burgh of Edinburgh," said that the Gas Industry had taken on a new importance since the war commenced. On top of its basic task of providing heat and light it had had to adapt itself to many processes demanded by a country at war. Their greatest problem was how to produce gas without coal. He knew, as a result of conversations with some of their members, that the position of the Gas Industry, with the winter coming on, was not as good as they would like, but it was better than they expected in Spring. In Spring he was informed there had been 3.4 weeks' reserve supply of coal for gas undertakings in Scotland. The Government decided that public utility undertakings should have a preference because it was on them that the public morale largely rested. Gas and electricity were the basic resources from which the people derived heat and light. A promise was given that by the end of August the reserve would be raised to four weeks' supply and that figure had been achieved for Scotland. A census taken on Aug. 29 showed the figure to be 4·1 weeks' supply as the average reserve. The Coal Supply Officer for Scotland had now agreed that by the end of October the figure would be at least five weeks' supply. Undertakings North of the Grampians would have six weeks' supply, and there would be an even greater reserve for undertakings in the islands round our shores. They would be at least assured of an iron ration.

Mr. McNeill thanked the Lord Provost and Edinburgh generally

for the warm spirit of hospitality exhibited to visitors, and concluded by extending an invitation from Greenock Corporation to the Association to hold its Spring Meeting in 1942 in Greenock.

Replying, the Rt. Hon. Sir HENRY STEELE, Lord Provost of Edinburgh, congratulated Mr. McNeill on his recent election to Parliament. No review of the activities of Edinburgh would be complete without a reference to its Gas Undertaking. The war work of the Gas Department was shrouded in secrecy, but he could say that these wartime problems were being dealt with most efficiently. The unwelcome attention of enemy bombers had not been allowed to deprive the public of their gas supply for any length of time, and prompt and effective assistance had been given to other undertakings in their time of need. The Edinburgh Gas Department had played its part in the development of the Industry, and by its researches had contributed to the common pool of knowledge. He himself could vouch for the efficiency of the Department. In his own works they had a tunnel oven, 440 feet long, where they had used their own producer gas in connexion with the manufacture of enamelled fireclay ware. The results were not satisfactory, however, till be arranged for Mr. Jamieson to install Edinburgh gas. The gas-fired tunnel oven had operated continuously night and day for twelve months without complaint. In war, the mutual interdependence of all units in the Industry was emphasized, and the Edinburgh undertaking, under their capable Gas Engineer, had been in the forefront of those national movements and organizations designed to contribute to the present security and future prosperity and usefulness of the Industry as a whole.

Mr. J. JAMIESON, Edinburgh, said that 23 years ago he went to Greenock as Assistant Gas Engineer. Mr. R. D. Keillor, their President, was then at school. Now he possessed a distinction sought by many, but given to few. Called unexpectedly to the chair through the death of Mr. Kellock, he had risen to the occasion. He had discharged his duties with distinction and borne the burdens of office in a difficult year with ability, diligence and thoroughness. He had been ably supported by the Members of Council and by Mr. Sturrock, their Secretary, whose persuasive but effective personality helped to make him both efficient and popular. He proposed a vote of thanks to the President, Council, Scrutineers, and Secretary.

Mr. STURROCK briefly replied and Mr. Keillor, closing the meeting, announced that as a result of the Golf Outing and that day's collection £30 14s. 6d. would be handed over to Lord Provost Sir Henry Steele for Edinburgh's Red Cross Fund. He also intimated that Mr. R. Fife, Kilmarnock, had been elected Junior Vice-President, with Messrs. J. M. Dow (Kirkcaldy), E. Smith (Paisley), and T. S. Lockhart Rothesay) elected to the Council.

BENZOLE RECOVERY BY REFRIGERATION

[Contributed]

ONE of the inconveniences—it can hardly be called a disadvantage—of the wash-oil process for benzole recovery is the fact that a vehicle is used at all, and that the benzole has to be recovered not only from the gas, but later also from the solvent. This also applies to benzole recovery with active carbon. I will discuss the process for recovering benzole which uses neither solvent nor adsorbent and directly recovers a crude product comparable in every way with crude benzole recovered by the more usual methods.

This process separates the benzole and the gas by refrigeration, which reduces the temperature of the vapour-gas mixture to the dew-point—that is, the temperature at which the vapour tension of the benzole falls below its partial pressure in the mixture. The dew-point is influenced in the first place by the amount of benzole contained in unit volume of the gas; and the following table[1] shows the variation of saturation concentration with temperature for benzole, toluole, and naphthalene mixtures with coke-oven gas and hence gives the maximum concentration of these three substances which can exist in the vapour state in the mixture at various temperatures. Thus, taking a common concentration of benzole in gas, 15 gr./cu.ft., the dew-point is reached at atmospheric pressure at about −16°C.; and to reduce the benzole content of the gas to 1 gr./cu.ft. the temperature has to be reduced to about −44°C.

Saturation concentration in coke-oven gas (gr./cu.ft.).

°C.	Benzole.	Toluole.	Naphthalene.
−60	0.18	0.10	*Nil.*
−50	0.57	0.25	...
−40	1.54	0.73	...
−30	4.1	1.68	...
−20	9.9	4.0	...
−10	24	8.6	0.005
0	48	16	0.018
10	89	31	0.07
20	147	54.5	0.20
30	240	84	0.57
40	354	136	1.41

If, now, the gas-vapour mixture is under pressure, say, of two atmospheres, then for equivalent benzole concentrations the partial pressure is doubled. Hence, the higher the pressure the more complete the removal of the benzole at a given low temperature; and, for example, whereas the dew-point at atmospheric pressure for a benzole concentration of 15 gr./cu.ft. is −16°C. it is about −7°C. at two atmospheres and 7°C. at five atmospheres. Equally, instead of the temperature at which 1 gr./cu.ft. of benzole remains in the gas being −44°C. at one atmosphere, it is about −38°C. at two atmospheres.

In practice, the necessary low temperature can be obtained in a variety of ways. One or other of the two most familiar methods of cooling a gas—by the use of a cooling liquid, such as ammonia, or by the compression and expansion of the gas itself—is used in all the plants operating the refrigeration process of benzole recovery; and two typical plants, one using the compression-expansion cooling system and the other the ammonia-circulation process, will be described below to illustrate the alternatives.

The first plant is that of the Société Sambre et Moselle at Montigny-sur-Sambre, Belgium. There are three units, each of capacity 250,000 cu.ft. of coke oven gas per hour; the gas normally contains 13 gr./cu.ft. of benzole, 0.35 gr./cu.ft. of naphthalene and 1.8 gr./cu.ft. of sulphur, principally as H_2S. It is free from ammonia. The gas is taken into the plant at holder pressure and is first passed through a single-stage compressor (see fig. 1), which raises its pressure to 3½ atmospheres. It is then cooled to atmospheric temperature in a water cooler, where 75% of the naphthalene separates and is drawn off through heated pipes. No benzole separates because the dew-point corresponding to the stated benzole concentration at the pressure used is about 10°C. In the two following evaporation coolers the raw gas is cooled by a returning stream of benzole-free gas to about 5°C., and the remaining naphthalene and the higher homologues of benzole (toluole and xylol) separate out with some water. The gas, which now contains only benzole and sulphur, passes to the twin counterflow coolers; these are so arranged that the gas can be led first into either cooler, the reason for this being that the operating temperature is such (about −30°C.) that benzole and water separate in solid form and gradually fill the passages. At any given time, the gas passing into the first counter-flow cooler is evaporating the frozen benzole and water, losing heat in the process, while in the second cooler it is depositing its benzole content on the cooling surfaces. When the pressure drop across the second cooler begins to rise, the gas flow is changed so that the first cooler becomes the second and *vice versa*, and in this way the accumulation of benzole in what was the second cooler is driven off.

The gas leaves the counter-flow coolers with a benzole content of about 0.9 gr./cu.ft., so that a recovery of some 93% is obtained. It passes at −30°C. to the expansion machine, which works off the same connecting-rod as the compressor. It leaves the expansion cylinder at −70 to −80°C., at which temperature the benzole content is under 0.05 gr./cu.ft.; at this temperature also the further quantity of benzole recovered is formed as a snow in the gas, and this snow is extracted in a cyclone. The cold gas then passes to the counter-flow coolers, where it reduces the temperature of the incoming partly debenzolized gas to −30°C., and then to the evaporation coolers. At its point of entry to the smaller of these coolers, it may be mixed with a water spray. The reason for this is that the returning gas can abstract from the incoming gas only its sensible heat leaving the latent heat of its benzole and water content still present to throw a very heavy load on the counter-flow coolers and thus on the expansion machine. If, however, a water mist is present in the returning gas where it enters the evaporation coolers its capacity for heat absorption is considerably increased and the load on the counter-flow coolers correspondingly decreased. But, if it is desired to distribute dry gas, this cannot be done and the extra power consumption in the expansion machine must be faced.

Although this plant has now been working well for a number of years initial difficulties were experienced. In the first place, frequent naphthalene stoppages occurred in the two first coolers. This trouble was overcome by occasionally stopping the flow of cooling water so that the temperature rose, causing the naphthalene to melt and flow away. Lubrication of the expansion machine also caused trouble on account of the low temperature and the solid deposits formed; but this was cured by the use of a mixture of toluole and denatured alcohol as lubricant. The toluole, which is specially made in the plant itself from the middle oil recovered in the small evaporation cooler, holds the benzole in solution and the alcohol dissolves the water. The third difficulty was from corrosion, caused by the unusually high sulphur content of the gas, and this has been overcome only to a degree; however, with a gas of more normal sulphur content such troubles should not arise.

The second plant to be described is that of the Société Carbochimique at Tertre, also in Belgium (see fig. 2). The hourly gas output of the coke ovens at Tertre is about 1,250,000 cu.ft., of which part is used for synthetic ammonia manufacture; for this purpose it has to be raised to a pressure of 12 atmospheres, so that there is an incentive for operating the refrigeration plant at a comparatively high pressure. As will be shown later, it was found that 5 atmospheres was the most economical working pressure; the whole of the gas is therefore compressed to 5 atmospheres by means of turbo-blowers and then passes to a cooler through which there turning cooled gas streams. From here the raw gas enters a water cooler, where practically the whole of the naphthalene separates, and then

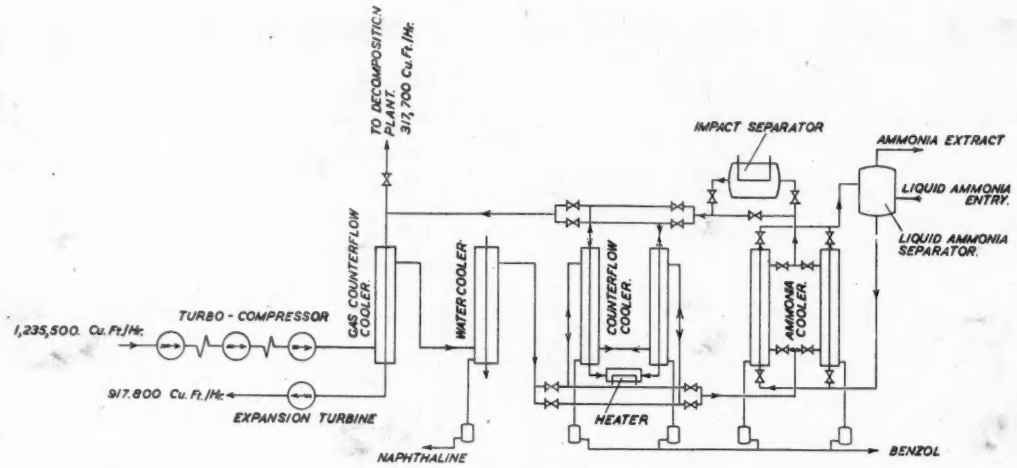


FIG. 1.

reaches a twin counterflow cooler of the same type and operated in the same way as that in the Montigny plant. The final cooling of the gas occurs in the heat-exchanger, through the synthetic liquid ammonia passes. Here the last traces of benzole vapour are removed from the gas either by freezing on to the cooling surfaces or by the formation of benzole snow, and the liquid ammonia is vaporized for subsequent use in the manufacture of ammonium sulphate, a process which is best carried out with gaseous ammonia. To help in maintaining the temperature of −40°C. which is found to produce the best recovery the ammonia is allowed to vaporize under reduced pressure. On its return journey the cold gas passes through a cyclone to remove benzole snow, then through the counter-flow coolers, after which the part destined for the ammonia plant is tapped off and further compressed. The remainder passes through the first gas cooler and is then decompressed in an expansion turbine.

According to one authority(2), the raw gas contains 14–15 gr. of benzole per cu.ft. and the cleaned gas not more than 1 gr./cu.ft. The original description of the plant(3, 4), however, quotes a more complete recovery than this, and illustrates at the same time the influence of variations in operating pressure on the degree of recovery. In what were presumably the first tests of the plant runs were made at two different operating pressures, roughly 1¼ atmospheres and 4 atmospheres, as follows:

	Test 1.	Test 2.
Pressure at compressor outlet, lb./sq. in. ...	18.5	56.9
Benzole content of raw gas, gr./cu.ft.	9.1	11.4 (min.)
Benzole content of gas after extraction, gr./cu.ft.	0.85	0.4 (max.).
Recovery, %	90.7	96.8

Thus, as already indicated, increasing the operating pressure also increases the efficiency of recovery; but the recovery at 4–5 atmospheres, the operating pressure finally chosen, is so close to 100% that further compression is uneconomic.

It is found that the quality of the benzole recovered by refrigeration is improved on account of the absence of naphthalene. Also, the low-boiling constituents, chiefly HCN and organic sulphur compounds, are absent as they remain in the gas; however, this does not mean that the crude benzole can be used direct as motor spirit, since the high-boiling fraction is unusually large and must be removed by distillation. The following two tables show first(5) the chief physical and chemical characteristics and secondly(6) the distillation analysis of benzole recovered by refrigeration at Montigny:

Density at 15°C.	0.882
Bromine index, g./100 cu.m. ...	...
	6.7
Phenols, %	0.1
HCN, %	0.17
Naphthalene, % ...	...abt. 2.0
Carbon disulphide, % ...	0.17
Thiophene, &c., %	0.11

°C.	% distilled.
65	First drop.
75	5
81	10
83	20
85	30
86.5	40
88	50
90.5	60
96	70
105	80
137	90

The fraction 90–95% requires the application of a temperature up to about 180–199°C. for removal.

(*Continued on p. 443*)

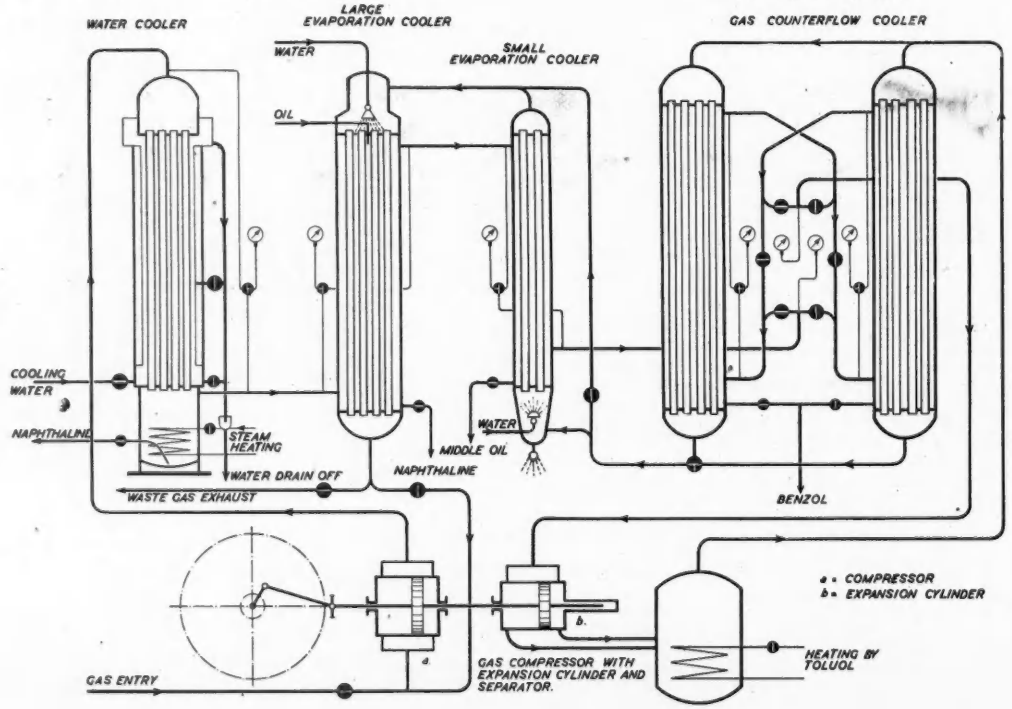


FIG. 2.

It is evident that the principal operating charge in the process will be that for electric power; and, in fact, it has been stated(7) that about two-thirds of the production costs are accounted for by charges for electricity while cooling water, lubricating oil and labour account for only one-third. The other heavy charge in the over-all costs is for capital interest and depreciation, since the plant is elaborate whichever method of cooling is adopted. The same authority states that capital charges form about one-third of the total costs. Thus, nearly half the total costs are accounted for by charges for power. On the other hand, a second authority(8) gives the following comparative figures for operating costs of benzole recovery from the same coke-oven plant, using first the wash-oil process and then the refrigeration process:

	Wash oil.	Refrigeration.
Benzole recovered per hour, kg.	200	229
Production costs per cu.m. of gas, Fr. cent.	0.99	1.15
Production costs per kg. of benzole recovered Fr. fr.	0.412	0.418

The difference is thus scarcely significant, being less than 1½%.

References

(1) WUCHERER, J.—*Stahl und Eisen*, 1938 (**85**), pp. 68-92.
(2) WUCHERER, J.—*Loc. cit.*
(3) *Ind. Chim. Belge*, 1935 (**6**), pp. 223-8.
(4) *Coal Carbonization*, 1935 (**1**), pp. 72-4.
(5) BERTHELOT, CH.—*Rev. de Métallurgie*, 1938 (**35**), pp. 439-447 and 509-522.
(6) WUCHERER, J.—*Loc. cit.*
(7) WUCHERER, J.—*Gas- und Wasserfach.*, 1935 (**78**), pp. 118-21.
(8) BERTHELOT, CH.—*Loc. cit.*

NEW FACTS ON LIQUID PHASE GUM*

By Dr. T. H. MIGHILL, *Research Chemist, Blackstone Valley Gas and Electric Co.*

THE subject of gum, in spite of its age, is undergoing a revival to-day. Several years ago attention was largely focused on vapour phase gum, and in the few following years the method of its formation and its behaviour were completely covered. I think that to-day more valuable information is at hand concerning this phase of gum than is available on liquid phase gum. Interest is now more concentrated on liquid phase gum owing to increased use of heavy oils in making water gas. It is to this form of gum that I am going to give some thought.

What is this substance we call liquid phase gum and how can we identify it? It has been stated that there is no specific test for this form of gum and I think that, in general, this statement is true.

For purposes of argument let me state that there are three points of view regarding gum: First, there are potential gum formers and possibly solid gum in solution in light oils; second, there are the more or less solid deposits in meters and on diaphragms; third, there is the resinous matter separable from light oil or deposits by proper manipulation. These resins are soluble in light oil, and when the latter has evaporated we have left a sticky mass of gum accompanied by the higher boiling fractions of light oil and generally considerable naphthalene. Oxidation has often taken place. Nitrogen and sulphur are often present in small amounts. The following are complete analyses of resins which I have isolated. These came from three plants and from four different localities in the plants.

Plant No. 1, light oil removed from gas by cooling with dry ice:

Carbon	89.60%
Hyrdogen	8.40
Nitrogen	0.13
Oxygen	1.09
Sulphur	0.38
Ash	0.40

This resin seems to consist almost entirely of polymerized styrene and indene.

Plant No. 2, light oil scrubbed from high pressure gas with straw oil:

Carbon	87.35%
Hydrogen	10.52
Nitrogen	0.11
Oxygen	1.48
Sulphur	0.53
Ash	0.01

Plant No. 2, condensate taken from the holder:

Carbon	84.41%
Hydrogen	7.46
Nitrogen	0.26
Oxygen	6.56
Sulphur	0.91
Ash	0.40

Plant No. 3, condensate from low pressure drips:

Carbon	72.70%
Hydrogen	8.48
Nitrogen	0.26
Oxygen	5.33
Sulphur	13.20
Ash	0.03

The high sulphur is probably due to inefficient purification of the gas.

Plant No. 2, light oil from high pressure drip:

Carbon	59.20%
Hydrogen	6.74
Nitrogen	1.04
Oxygen	30.64
Sulphur	0.23
Ash	2.15

Absorption of oxygen has taken place through long standing under pressure.

Other analyses may be found in the literature. Analyses like the above are tedious but they show better than any other methods whether the gum in question is due to polymerization alone or also to oxidation. There is also a suggestion that sulphur plays a role in the formation of gum which has not as yet been investigated.

It has been recognized for a score or more years that these resins are formed by the polymerization of two unsaturated hydrocarbons, styrene and indene. Each of these bodies has a strong affinity for oxygen and there is at times enough oxygen in the gas to enable oxidized gum to form.

* Paper presented at a meeting of the Operating Division, New England Gas Association, Worcester, Mass., May 7, 1941.

While a few low boiling gum formers exist they are not likely to occur in any significant amount in ordinary light oils.

I have used the method proposed by Dr. Ralph Brown for determining styrene and indene for several years. For the fractionation I use a twelve bulb distilling column with pear-shaped bulbs. I have also used the Young and the Vigreaux columns. With the last two it is necessary to lag the column with a towel or other suitable material in order to reach the higher temperatures of the distillation. Operating this way the fraction distilling between 140°C. and 160°C. contains the styrene and the fraction 160°C. to 190°C. the indene. The residue is now transferred to a Claissen flask and an air-cooled condenser added which in turn is connected to a vacuum receiver. By so doing a reduction of about 100°C. in the boiling points of the remaining oils is attained which minimizes the formation of gum by heat.

The naphthalene distils at a pressure of ½ in. vacuum at slightly over 100°C. By chilling the distillates with ice practically all of the naphthalene can be recovered by filtering the deposited crystals on a suction filter.

The gum remaining in the flask is liquid while hot but on cooling it will solidify. The flask should be tared before the distillation and by weighing after the distillation the amount of resin can be determined The liquid resins can be poured out of the flask for further examination.

There is an uncertainty whether the resin is already formed in the light oil or whether it is formed by heat during distillation. By completely distilling the oil in vacuo gum is always found, so the inference is that it existed in the oil before distilling. The use of gum inhibitors in the distillation may help answer this question. Already practical use of inhibitors at Baltimore in preventing formation of gum in recovering scrubbing oil has been attained.

The styrene and indene fractions are brominated in solution in carbon tetrachloride to a brown end point which persists for half a minute. The Francis method can also be used. The reagent used here is a solution of potassium bromide and potassium bromate, which liberates bromine on acidifying. The use of sulphuric acid to remove the gum formers is not to be recommended as the handling of sludge and emulsion is very difficult.

I have found even when using pure styrene and indene that the values obtained by using the above method are invariably too low. The same is true with the Francis method. However, if the bromination is carried out in a weak light and the solution cooled with ice, an excess of bromine added and allowed to stand for half an hour, correct results are obtained. Substitution of bromine for hydrogen does not occur to any serious extent, as I have shown by tests for hydrobromic acid.

Pure styrene I prepared by decomposing cinnamic acid by heat, steam distilled the product, and fractionated the dried oil in vacuo. Pure indene I prepared by treating the indene fraction of light oil heated on a water bath with the calculated amount of picric acid very carefully added. It is very essential not to let the temperature rise above that of boiling water on account of the danger of decomposing the picric acid. On cooling indene picrate deposited, which was filtered on the suction pump and crystallized from benzole. When the crystals gave the right melting point they were decomposed by steam and the oil steam distilled at the same time. From the aqueous distillate the indene was extracted with petroleum ether. This procedure is a possible way of testing for indene in light oil but it is not to be recommended as it is time-consuming as well as somewhat dangerous.

What was found to be true for pure indene and styrene was also true when the indene or styrene was diluted with paraffins from which all unsaturates had been removed. Check tests made by changing styrene to the bromide and indene to the picrate showed that the modified bromination method gave practical results. To show the ease with which olefines are brominated some amylene was prepared by treating amyl alcohol with sulphuric acid and rectifying the product. This was quickly and easily brominated to saturation in a few minutes.

One of the distinguishing tests between vapour phase and liquid phase gum has been that vapour phase gum is soluble in sodium hydrate. However, as I have found much liquid phase gum to also be soluble in caustic soda, I do not believe this proposed test to distinguish between the two forms of gum to be valid.

One property of liquid phase gum is its insolubility in alcohol, or its precipitation from solution on adding alcohol. This test will distin-

(*Continued on p. 446*)

For every size of works and every class of coal...

WEST'S

CARBONIZING PLANTS

GLOVER-WEST VERTICALS

WESTVERTICAL CHAMBERS

440 carbonizing plants have been built or are under construction by West's in 24 countries. Working results from a wide variety of gas coals have established the high efficiency and adaptability of the West systems.

WEST'S

GAS IMPROVEMENT CO · LTD ·

MILES PLATTING MANCHESTER 10

TELEPHONE—COLLYHURST 2961-2-3-4-5 · TELEGRAMS—STOKER, MANCHESTER

LONDON OFFICE TEMPORARY ADDRESS—BATH ROAD · HARMONDSWORTH WEST DRAYTON MIDDLESEX TEL.—WEST DRAYTON 2288-9

Gas Products Prices

The London Market

Sept. 15.

Prices of Coal Tar Products in the London market remain to-day approximately as follows:

Pitch is nominal; creosote about 5d.; refined tar 3¾d. to 4d.; pure toluene under the Ministry of Supply Toluene No. 2 Order 2s. 5d.; pure benzole is 1s. 10d.; 95/160 solvent naphtha 2s. 5d. to 2s. 8d., and 90/160 pyridine 13s. 6d.; all per gallon naked; refined crystal naphthalene £23 per ton in bags; all *ex* Makers' Works.

The Provinces

Sept. 15.

The average prices of gas-works products during the week were: Pitch and Crude Tar,* Toluole, naked, North, 1s. 10d. (controlled by the Control of Toluene No. 2 Order, July 5, which fixes the maximum price at which this material may be sold). Coal tar, crude naphtha, in bulk, North, 10d. to 11d. Solvent naphtha, naked, North, 1s. 9d. to 1s. 10d. Heavy naphtha North, 1s. 6d. to 1s. 7½d. Creosote, *ex* works, in bulk, North, liquid and salty, 4¼d. to 4¾d.; Scotland, 4¼d. to 4¾d.; low gravity, 4½d. to 4¾d. Fuel Grade, 4d. to 4¼d. Carbolic acid, 60's, 3s. 7½d. to 3s. 9d. Naphthalene, £12 to £15. Salts, 70s. to 80s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal. Heavy oil: Unfiltered anthracene oil (min. gr. 1,080), 5¼d. to 5½d.; filtered heavy oil (min. gr. 1,080), 5¾d. to 6d.; heavy anthracene oil gr. less than 1,080, 6d. to 6¼d.

*In regard to pitch and crude tar prices we would ask readers to refer to the editorial note on p. 396 of last week's issue.

Tar Products in Scotland

GLASGOW, Sept. 13.

Trading is quietly steady and prices generally continue strong.

Refined tar: This is being produced as required at the fixed price of 4¾d. to 5d. per gallon for delivery in the home market, while in the export market supplies can be secured at round 3½d. per gallon, both f.o.r. naked.

Creosote oil of all grades is in good call with prices as under: Specification oil, 5¾d. to 6d. per gallon; low gravity, 6½d. to 7d. per gallon; neutral oil, 6d. to 6¼d. per gallon; all *ex* Works in bulk.

Cresylic acid: Production for some time forward is well looked after and, in the absence of spot lots, prices can only be taken as nominal: Pale, 99/100%, 3s. 9d. to 4s. per gallon; Pale, 97/99%, 3s. 5d. to 3s. 8d. per gallon; Dark, 97/99%, 3s. to 3s. 3d. per gallon; all *ex* Works in buyers' packages.

Crude naphtha shows no alteration at 6½d. to 7½d. per gallon *ex* Works in bulk, according to quality.

Solvent naphtha: 90/160 grade is 1s. 8½d. to 1s. 9d. per gallon and 90/190 Heavy Naphtha is 1s. 4½d. to 1s. 5½d. per gallon.

Pyridines remain quiet at about 14s. per gallon for 90/160 grade and 16s. per gallon for 90/140 grade.

Ardrossan Town Council intimate that they have reduced the price of gas, as from the current survey of meters, to 4s. 4½d. per 1,000 cu.ft. to ordinary customers and 4s. 7d. to consumers by prepayment meter.

Gas Stocks and Shares

The news from Russia and later in the week President Roosevelt's speech gave a firm tone to markets. British Funds set a strong lead, while outside this section the chief attention centred round Rand gold-mining shares. Among British Funds 3½% War Loan closed at 106⅜, a price not touched since 1936, and 2½% Consols finished 1 point higher than a week ago at 82½. The home railway market was not so busy, but prices generally were well maintained. The tone of the industrial market was firm and a number of issues showed small gains. Some profit-taking took place among oil shares, but on the whole quotations closed with little change. Active buying in the Kaffir market led to some good improvements, "Blyvoors" being a strong feature.

There was a distinctly heavier volume of business in the Gas Market than during the previous week and the demand was more widespread. There were only a few price changes, however, but with one exception these were all in an upward direction. Gas Light units recovered some of their previous losses and closed 6d. higher at 13s. 6d., and British ordinary on support was 3 points higher at 73½. Oriental stock changed hands at 125 and the quotation was marked up 2 points to 123½. On the Provincial Exchanges Bristol ordinary hardened 2 to 90.

The following is the complete list of price changes and *ex div.* markings which occurred during the week:

OFFICIAL LIST

British Ord.	71—76	+3
Gas Light Units	13/—14/-	+-/6d.
,, 4 p.c. Pref.	63—68	+1
,, 3½ p.c. Red. Deb. (*x.d.*) ...	79—84	Sept. 8
Imperial Continental 3½ p.c. Red. Deb.	76—81	+1
Oriental	121—126	—2
South Suburban Ord. (*x.d.*)	60—65	Sept. 8
,, ,, 5 p.c. Pref. (*x.d.*) ...	72—77	,,
,, ,, 4 p.c. Pref. (*x.d.*) ...	63—68	,,
,, ,, 3½ p.c. Red. Pref. (*x.d.*)	78—83	,,

SUPPLEMENTARY LIST

Plymouth & Stonehouse (*x.d.*) ...	83—88	Sept. 8

PROVINCIAL EXCHANGES

Bristol Ord.	89—91	+2
Glossop Ord. (*x.d.*)	16¾—17¾	Sept. 1
Newcastle 4 p.c. Pref.	82¼—83¼	—¼
,, 3½ p.c. Deb. (1958/63) ..	88—89	+2½

Metro

TRADE MARK.

IN normal circumstances this space is occupied by information concerning the many Coal Tar and Ammonia Chemicals produced by the South Metropolitan Gas Company.

MANY of these products, required in the last war, are wanted more than ever to-day for war purposes.

CERTAIN "Metro" products, however, are available for normal business, such as Medium Soft Coal Tar Pitch, Creosote Oils, Dry Neutral Sulphate o Ammonia, etc., and enquiries for these should be directed to the manufacturers:—

SOUTH METROPOLITAN GAS COMPANY

Products Department:
REGIS HOUSE,
KING WILLIAM STREET,
E.C.4.

Telephone: AVENUE 2755.

guish gum from tar, pitch, or naphthalene. The gum resins are generally dark coloured but sometimes as light as shellac. Thin edges are generally red by transmitted light. On burning, the resins give off an aromatic odour and not the acrid odour of burning pitch or tar.

To determine whether light oil contains gum formers tests for styrene and indene must be made. First, distil the light oil and save the styrene and indene fractions.

There is really no good test for styrene. The most practical one seems to be to form the bromide, crystallize the latter from alcohol, and determine the melting point. The best known test for indene is to brominate the oil and boil with water. Separate the oil left by filtration and cool. If indene is present, fine needle-like crystals of indene oxybromide will be deposited and their melting point determined.

The refractive index of indene is unusually high but unfortunately it cannot be approached until pure indene is all that is present. So this test is of little value.

Indene is said to form a compound with metallic sodium. However, its formation is uncertain and decidedly risky, as I have learned.

Last year I developed a very sensitive test for indene which I have proved by the use of pure styrene, pure indene, and amylene to be due to indene alone. Having obtained the indene fraction from light oil by distillation this test is easy, delicate, and takes but a few minutes to perform. It is as follows:

Take any suitable dry cylinder of glass—a 100 c.c. oil bottle is very good—and put in it 10 c.c. of acetone. Then add a drop of the suspected indene. Then add five small pellets of potassium hydrate. No apparent change will take place. If, now, a c.c. of chloroform be added and the bottle gently shaken, in a few seconds a beautiful blue colour will develop. This blue will be quite deep if any considerable amount of indene is present. This seems to be a condensation phenomenon but, unfortunately, the blue colour is transitory as the condensation, if it be one, proceeds further and the blue is followed by a yellow colour and generally winds up with a white or grey colour. However, the blue colour lasts long enough for positive identification. For this reason I have not been able to develop any quantitative procedure therefrom. If one drop does not bring the blue, several drops can be taken.

The blue colour produced can be permanently imitated by dissolving 3.0 g. of crystals of copper sulphate in 50 c.c. of water and adding 1.0 c.c. of a solution of one gramme of potassium permanganate in 1000 c.c. of water.

The same procedure gives an excellent test for carbon bisulphide in the first runnings of light oil, only in this case the colour is a fine orange and quite permanent.

The following information may be useful to any experimenter:

	Naphthalene.	Styrene.	Indene.
Sp. gr.	1.145	0.907	1.006
Melting point	80°C.		—2°C.
Boiling point	218°C.	146°C.	182°C.
Refractive index 25°C.		1.5440	1.5747
Styrene bromide, M.P.	73°C.		
Indene oxybromide, M.P.	131°C.		
Picric acid, M.P....	122°C.		
Naphthalene picrate, M.P.	149°C.		
Indene picrate, M.P.	98°C.		

NEW PATENTS

Mounting Heat Radiating Elements

Cannon Iron Foundries, Ltd., R. T. Clayton, and A. F. Oatley have been granted a patent (No. 537,897; application date, Feb. 9, 1940) relating to the mounting of heat-radiating elements made of wire in such apparatus as gas fires

In an electric heating element of the kind comprising a rod with insulating discs threaded thereon and carrying the wire, it has been proposed to inset a U-shape bimetal strip between the end disc at each end of the rod and an abutment on the rod, to hold the disc against relative displacement under changes of temperature in the rod.

In accordance with the present invention the bimetallic member is a bracket having a free part which is clear of the wire or rod of the heating element, but lies adjacent to an abutment on the wire or rod, which is independently supported and arranged so that it is relieved of tension until there is expansion under heat that would cause sagging of the element to occur.

FIG. 1

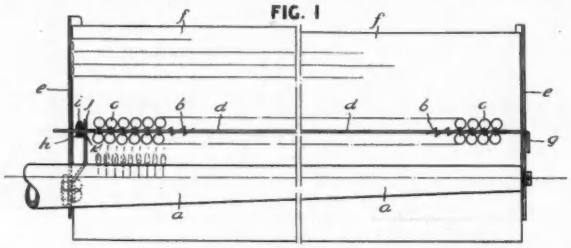


Fig. 1 is the front elevation of the radiating portion of a gas fire with a burner tube and reflector back with the invention applied thereto.

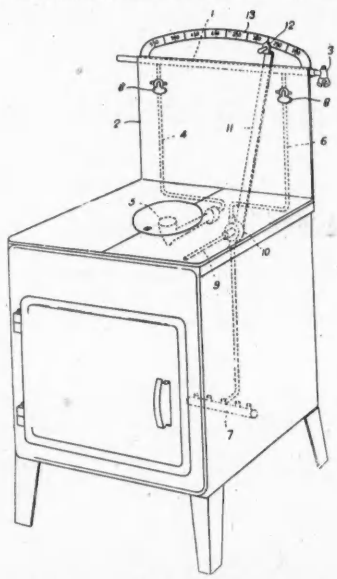
In fig. 1 the burner tube *a* is intended to represent an aerated burner provided with a number of flame ports all along it as indicated at the left of the diagram. Above this burner is a gas-heated radiating body *b* for which is employed a helically wound filament of fine wire of heat resisting metal, on which is threaded a helix, of further fine wire of helical or interwoven form, which is represented as in section by the circles *c*. This larger diameter helix and its interlacing helix *b* is loosely wound around a thicker heat resisting wire or metal rod *d*. The rod *d* is loosely supported in the side walls *e* of the frame of the gas fire or radiator or of the reflecting insert therein. It extends as shown in fig. 1 directly above and parallel to the aerated burner *a*, so that the flames on the flame ports will heat this radiating body to the desired intensity. Behind the body and burner and between the side walls *e* is shown a reflecting backing *f*. The rod *d* may be cranked at one end as shown at *g* in order to anchor that end outside the frame or insert wall *e*, and may be left straight at the other end where it passes freely through a hole of larger diameter in the wall *e*. A collar *h* is adjustably secured on this rod *d* such as by means of a set screw *i* impinging on the wire, and between this collar *h* and the helical filament wound about the rod is arranged an upstanding bracket *j* having a slot or large hole *k* through it, through which the end of the filament passes quite freely. The bracket *j* is made of a bi-metallic strip, such as an alloy of low thermal expansion and brass rolled together, and it is attached to the end wall *e* with the metal having the larger co-efficient of expansion (brass) towards the heated filament *b*.

When the burner is supplied with an air and gas mixture and ignited the radiating element is heated throughout its length and expands. It is free to move in either direction. It cannot distort or sag, however, since the bi-metallic bracket *j* as it is heated will tension it by bending away from the helical winding, engaging the collar *h* on the rod *d* and moving that collar towards the wall *e* of the frame or the like. In this movement under the action of heat the cranked part *g* at the other end of the rod first encounters the wall *e* adjacent to it and any further movement of the bracket *j* then applies the desired slight tension to the rod of the radiating element.

Oven Heat Control

The South Metropolitan Gas Company and Dean Chandler have taken out a patent (No. 538,148; application date April 19, 1940) whereby the supply of gas to the oven burner is controlled by a thermostat which is regulated by a lever rigidly connected with the control head of the thermostat, and extending upwards therefrom, and working against a scale at the back of the cooker. The invention, which may be applied with advantage to the gas cooker described and claimed in Specification No. 32507 of 1939 (Serial No. 537,189), is illustrated in the accompanying perspective drawing.

The main gas supply pipe 1 runs substantially horizontally along



the back of the splash plate 2 of the cooker and terminates in a plug-in cock 3. Descending at intervals from the main 1 are a pipe 4 for supplying the open burner 5 and a pipe 6 for supplying the oven burner 7, each pipe having a tap 8 situated sufficiently high above the open burner to be accessible when the latter is alight. The pipe 6 for supplying the oven burner 7 has a regulable thermsotat 9 situated between the tap 8 and the burner, and fixed to the control head 10 of the thermostat is a lever 11 which extends upwards behind the splash plate 2. The upper end of the lever 11 terminates in a pointer 12 which works against a scale 13 extending across the whole width of the top of the splash plate. The scale may be calibrated in temperatures or in an arbitrary scale of letters or numerals, and is large enough to carry, if desired, a legend showing the kind of foodstuff to which each etting is appropriate.